

APPARENT OVERWINTERING OF *BIPRORULUS BIBAX* BREDDIN (HEMIPTERA: PENTATOMIDAE) ON *EREMOCITRUS GLAUCA* (RUTACEAE)

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Abstract

Two aggregations of adult *Biprorulus bibax* each comprising approximately 50 individuals, were observed on *Eremocitrus glauca* at Chinchilla, Queensland in May 1992. Laboratory analyses revealed the aggregations to be comprised of non-reproductive bugs with large lipid reserves. The occurrence of non-reproductive *B. bibax* on *E. glauca* in late autumn suggests this plant is a winter as well as a summer host.

Introduction

B. bibax, a native pentatomid, has recently extended its range to become a serious pest of citrus in inland southern Australia (James 1989). Aspects of the biology and ecology of *B. bibax* including overwintering (James 1990 a, b; James *et al.* 1990; James 1991), have been studied in developing an integrated management strategy (James 1993).

In southern New South Wales adult *B. bibax* enter reproductive diapause during March in response to declining daylength (James 1991) and overwinter in aggregations of 10-100 in oranges, grapefruit or mandarins, usually adjacent to lemon groves (James 1989, 1990 a, b; James *et al.* 1990). Overwintering bugs contain extensive lipid reserves which aid survival until spring (James 1990a).

The overwintering ecology of *B. bibax* on its primary native host, *Eremocitrus glauca* (Lindl.) Swing. (desert lime), is unknown. Summerville (1931) reported the presence of *B. bibax* on this host during summer in western Queensland but not during winter. James (1992) reported summer non-reproductive populations of *B. bibax* on non-fruiting *E. glauca* in western Queensland (Roma, Chinchilla) and western New South Wales (Roto). Spring and summer breeding populations in these areas have also been recorded (James unpubl. obs.). Summerville (1931) also recorded "fairly large numbers" of *B. bibax* on another native citrus species, *Microcitrus australasica* (F.Muell) Swing., in October and suggested that this plant may be an overwintering host. However, *M. australasica* is largely coastal in distribution requiring bugs to fly long distances between winter and summer habitats. Summerville (1931) recognised this and searched in vain for an additional inland winter host.

This note reports the occurrence of aggregating non-reproductive *B. bibax* on *E. glauca* at Chinchilla in late autumn 1992.

Materials and Methods

A visit was made on 17.v.1992 to locations near Chinchilla in western Queensland, previously observed to harbour summer breeding and non-breeding populations of *B. bibax* (James 1992 and unpubl. obs.). Four hours

were spent searching thickets of *E. glauca* for *B. bibax*. Conditions were overcast with temperatures of 18-20°C.

All adult *B. bibax* encountered were collected and held in muslin covered cages with foliage of *E. glauca* for seven days. Temperatures during this period ranged from 5-22°C. After seven days bugs were sexed and 10 females dissected for determination of reproductive status. Ovaries were examined for oocytes and a distended, pigmented spermatheca indicated insemination. A sample of 23 males and 26 females was analysed for size, weight and lipid reserves. Bug size was recorded as the distance between tips of the pronotal spines, measured under a microscope fitted with a micrometer. Individual wet weights were recorded before storage in a freezer (-20°C) for later processing. Bugs were dried overnight in an oven at 60°C and then weighed; they were then individually ground using a mortar and pestle. Gross lipid content was determined using the technique described by Tuskes and Brower (1978), and expressed as mg/bug or g/0.1g dry weight. Lean dry weight was recorded as the difference between dry weight and lipid weight.

Results and Discussion

Two tightly-packed aggregations of adult *B. bibax* were found on *E. glauca* trees approximately 50 m apart. No other bugs of this species were found. Each aggregation contained approximately 50 bugs which were spread along a single upright branch at a height of approximately 2 m. All bugs were oriented towards the sky and in some patches were two to three deep. The aggregations were highly cryptic, due to perfect colour match between bugs and plant and the striking similarity between bug and plant spines. James (1990a) suggested the pronotal spines of *B. bibax* might serve as an aid to crypsis and this was supported by these observations.

All dissected females were unmated and showed no ovarian development. The sex ratio of sampled bugs was 1:1 (42 male, 43 female). Data on size, weight and lipid content of sampled *B. bibax* are summarised in Table 1. As with *B. bibax* in commercial citrus in southern Australia, females were significantly larger and heavier than males (Analysis of Variance, $P < 0.05$). Body weights and lipid content were generally lower than those reported for individuals in late autumn aggregations on commercial non-lemon citrus in New South Wales and Victoria (James 1990a; James *et al.* 1990). Bugs in these aggregations generally show lipid levels of 0.040-0.048 g/0.1g. However, lipid content of the Chinchilla bugs (0.036 g/0.1g) was higher than that recorded for summer reproductive bugs or for bugs which remain on lemon during winter (0.015 - 0.024 g/0.1g) (James 1990a; James *et al.* 1990).

The occurrence of aggregating, non-reproductive, lipid replete *B. bibax* on *E. glauca* in late autumn, suggests that overwintering can occur on this host. Reproductive populations of *B. bibax* were observed on *E. glauca* in the same area during the previous spring (James unpubl. obs.). The progeny of this population may have entered a summer reproductive dormancy as reported by James (1992) for populations in this district, which then continued into

Table 1. Mean (\pm SE) size, weight and lipid content of 23 male and 26 female *B. bibax* collected from *E. glauca* at Chinchilla in May 1992.

Sex	Width (mm)	Wet weight (mg)	Dry weight (mg)	Lean dry weight (mg)	Lipid (mg)	Lipid (g/0.1g)
Male	14.2 \pm 0.1	245 \pm 8.5	143 \pm 7.3	92 \pm 5.0	51 \pm 3.5	.036 \pm .002
Female	* 14.7 \pm 0.2	* 283 \pm 14.5	* 181 \pm 8.7	* 113 \pm 4.8	* 67 \pm 4.2	.036 \pm .001

* significantly greater than corresponding value for males

winter. Alternatively, dormancy may have broken in late summer giving rise to an autumn generation which entered photoperiodically-cued winter dormancy, as occurs in New South Wales and Victoria. Further studies are required to determine the phenology of *B. bibax* on *E. glauca*. Summerville (1931) did not find *B. bibax* on *E. glauca* during winter but may have overlooked the cryptic aggregations of bugs. In this study approximately 100 trees were searched yet only two harboured *B. bibax*. The well-defined movement of *B. bibax* in commercial citrus in southern Australia from a summer host (lemon) to a winter host (orange/mandarin/grapefruit) might be expected to have its origins in the ancestral habitat. The possibility of an additional winter host for *B. bibax* in western areas of Queensland and New South Wales therefore cannot be discounted.

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References

- JAMES, D.G. 1989. Population biology of *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae) in a southern New South Wales citrus orchard. *Journal of the Australian Entomological Society* 28: 279-286.
- JAMES, D.G. 1990a. Energy reserves, reproductive status and population biology of overwintering *Biprorulus bibax* (Hemiptera: Pentatomidae) in southern New South Wales citrus groves. *Australian Journal of Zoology* 38: 415-422.
- JAMES, D.G. 1990b. Seasonality and population development of *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae) in south western New South Wales. *General and Applied Entomology* 22: 61-66.
- JAMES, D.G. 1991. Maintenance and termination of reproductive dormancy in an Australian stink bug, *Biprorulus bibax*. *Entomologia Experimentalis et Applicata* 60: 1-5.
- JAMES, D.G. 1992. Summer reproductive dormancy in *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae) on *Eremocitrus glauca* (Rutaceae) in south-eastern Queensland and western New South Wales. *Australian Entomological Magazine* 19: 65-68.

- JAMES, D.G. 1993. Integrated management of *Biprorulus bibax* (Breddin) (Hemiptera: Pentatomidae) in inland citrus of south-eastern Australia. *Proceedings of Fifth Australian Applied Entomological Research Conference*. Pp. 96-98. C.S.I.R.O.
- SUMMERVILLE, W.A.T. 1931. The larger horned citrus bug. *Bulletin of the Division of Entomology and Plant Pathology, Queensland Department of Agriculture and Stock* No. 8.
- TUSKES, P.M. and BROWER, L.P. 1978. Overwintering ecology of the monarch butterfly, *Danaus plexippus* L., in California. *Ecological Entomology* 3: 141-153.